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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/584,352	06/23/2006	Takashi Kikuchi	062688	3355

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EXAMINER	
SLAWSKI, BRIAN R	

ART UNIT	PAPER NUMBER
1791	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/584,352	KIKUCHI ET AL.	
	Examiner	Art Unit	
	BRIAN R. SLAWSKI	1791	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 April 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-3,5 and 6* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3,5 and 6* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

METHOD OF MANUFACTURING FLEXIBLE LAMINATE SUBSTRATE

Detailed Action

1. Applicant's request for reconsideration filed on April 20, 2009, was received. Claim 1 was amended. Claim 4 was cancelled.

2. The text of those sections of Title 35, U.S. Code not included in this action can be found in the Office action mailed on December 19, 2007.

Claim Rejections—35 USC §103

3. Claims 1-3, 5, and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hase et al. (WO01/32418) in view of Fukada (US 2002/0108709) and Frisbie (US 3,360,210; newly cited). (Subsequent references to Hase et al. are based on the corresponding U.S. Patent No. 7,101,455).

Regarding Claim 1, Hase et al. teach a method of laminating a flexible circuit board substrate 6, by bonding copper foils 1 to both surfaces of a heat-resistant thermoplastic polyimide adhesive film 2. The laminate is thermally bonded via a protective film 3 between one or more pairs of metal rolls 4, after which the protective film is peeled off around peeling assistant rolls 8 (Abstract ; Fig. 1(a); col. 1, L. 25-31 ; col. 2, L. 8-19; col. 8, L. 16-37).

Hase et al. teach that the coefficient of thermal expansion of the polyimide film is greater than that of the copper foil during lamination of these materials by heating; hence the polyimide film expands faster than the copper foil under tension in the

adhesion process, then shrinks faster than the copper foil during cooling, causing the laminate to wrinkle (col. 1, L. 63-67; col. 2, L. 1-7; col. 3, L. 11-31; col. 7, L. 38-53). Hase et al. teach that a further contributing factor to wrinkling is the state of flux in which the thermoplastic polyimide remains following lamination, as the polyimide must be heated above its glass transition temperature to bond to the metal foils, and as the thermally pressured laminate maintains heat even if pressure is released immediately after thermal lamination (Fig. 2; col. 5, L. 46-49; col. 7, L. 54-60). Hase et al. teach compensating for these effects to minimize wrinkling by reducing tension on the materials before lamination to the minimum needed for the webs to stably proceed, and by forcedly cooling the laminate downstream of the metal rolls so that its temperature is preferably not higher than its T_g when the protective film is peeled (col. 3, L. 11-21; col. 5, L. 32-38; col. 8, L. 29-39, L. 49-52, L. 61-65; col. 9, L. 3-5; col. 11, L. 9-18, L. 39-42).

Hase et al. do not specifically describe the tension on the laminate after passage through the metal rolls. However, the skilled artisan would have understood from the above teachings that the polyimide film would remain hot and fluid, and the laminate thus vulnerable to wrinkling by mismatched elongation and flow if subjected to much tension, after leaving the metal rolls. Hence, it would have been obvious to one of ordinary skill in the art to apply the lowest practicable tension to the laminate of Hase et al. immediately following the metal rolls, in order to avoid wrinkling the laminate.

Hase et al. do not specifically describe the tension applied to the laminate during peeling of the protective films 3 around the peeling assistant rolls 8. However, Fukada also teaches peeling a laminated film (in this case, a waste matrix 4) from a moving

substrate web 1 around a peeling roller 3, and explains that during the peeling process tension must be applied to the web 1 in order to stably transport the web 1 and stably separate the waste matrix 4. Fukada teaches that one possible means of applying this tension is with an upstream brake roller 8 that opposes the downstream driven roller 7 advancing the moving web 1 (Fig. 1, 2; [0007-0008]).

Though Fukada uses an upstream brake roll rather than nip rolls to regulate tension on the substrate web during peeling, Frisbie similarly teaches stripping a laminated waste matrix from a substrate web, and provides the necessary tension in the stripping section using upstream nip rolls 18 and downstream driven tension rolls 20 (Fig. 1; col. 2, L. 54-57; col. 3, L. 13-20, L. 22-25, L. 34-38, L. 46-48). Further, Hase et al. teaches an embodiment in which the laminate passes through multiple pairs of nip rolls 4a (of which only the first pair is heated) before delaminating the protective film (Fig. 4; col. 14, L. 56-65). It would have been obvious to one of ordinary skill in the art to likewise tension the laminate of Hase et al. during this delamination, using the nip rolls 4a as in Frisbie to regulate tension downstream, because both Fukada and Frisbie teach that a substrate web must be pulled taut to remain stable when peeling a laminated film therefrom, and because Frisbie shows that upstream nip rolls are an effective way to provide this tension in the peeling section.

While Fukada and Frisbie do not explicitly disclose the ratio of tension in the peeling section to that in the upstream section, both clearly teach that this ratio should be greater than unity—i.e., that the substrate web is less stable and therefore needs greater tension while peeling its laminated film than in preceding operations. In

particular, the skilled artisan familiar with Fukada and Frisbie would have known to exert significantly more tension on the laminate 6 of Hase et al. while peeling the protective films than immediately after lamination, in that the teachings of Hase et al. would inform this artisan that minimal tension should be applied just after lamination to prevent wrinkling. It would have been obvious to one of ordinary skill in the art to select the ratio of tensions in these two sections of Hase et al. to be at least 1.2 in light of the combined teachings of Hase et al., Fukada, and Frisbie.

Claims 2, 3, 5, and 6 are rejected for the same reasons as those presented in paragraph 4 of the Office Action issued December 22, 2008; Applicant is referred to the same for a complete discussion of these rejections.

Response to Arguments

4. Applicant's arguments filed March 18, 2009, have been fully considered but they are not persuasive. Applicant argues that Hase et al. does not suggest that their laminate's outer appearance will worsen if tension is not applied while peeling the protective films, that Fukada does not disclose applying two different tensions to a laminate, and therefore that a person skilled in the art would not be motivated to apply two different tensions to the laminate of Hase et al. as in the instant application. Applicant further argues that, though Hase et al. minimize tension on the pre-lamination webs, Hase et al. also teach that tension on the metal foils may exceed that on the polyimide film before lamination, while after the laminating rolls' nip the materials will all

be under equal tension, such that the tensions are different before and after lamination in Hase et al.—i.e., that tension after lamination will not be reduced to the minimum.

While it is true that Hase et al. does not specifically describe the tension on their laminate when peeling the protective films, the examiner contests Applicant's assertion that Fukada does not disclose the concept of applying two different tensions. Fukada states that "tension must be applied in order to stably transport the web 1 and stably separate the waste matrix 4 from web 1" [0008], and provides this tension with a brake roller just before the separation and a driven roller just after. Hence Fukada clearly applies more tension to the laminate during peeling than before—otherwise there would be no need for the brake roller. One skilled in the art would have realized from Fukada's teachings that more tension is needed to stabilize the laminate of Hase et al. when peeling its protective films than before the peeling region. Moreover, Frisbie shows that a pair of nip rolls before the peeling region can be used instead of a brake roller to provide this increased tension, while Hase et al. teach that several such nip rolls 4a can be added between their laminating rolls and peeling assistant rolls 8. It would have been obvious to use these nip rolls 4a to provide increased tension in the peeling region in light of Fukada and Frisbie.

Furthermore, though Hase et al. teach different tensions on the various materials before laminating, and while it is true that the tensions on all the materials will be equalized after passing the metal rolls' nip—such that tension on at least some materials will differ before and after the metal rolls—the examiner nonetheless maintains that Hase et al. motivate the skilled artisan to exert very little tension on the

laminate just after the metal rolls. Hase et al. teach that wrinkling of the laminate is caused by the different expansion rates of its materials and state of flux of the polyimide resulting from thermal lamination, that this wrinkling is worsened by tension on the laminate when hot and fluent, and that the laminate retains heat and stays above the polyimide's T_g after leaving the metal rolls, so that one of ordinary skill in the art would have known that the laminate remains vulnerable to wrinkling by excessive tension after leaving the metal rolls and before cooling. Hence it would have been obvious to apply more tension to the laminate of Hase et al. during delamination than just after lamination, and to choose a ratio of tensions in these respective sections of at least 1.2.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to BRIAN R. SLAWSKI whose telephone number is (571)270-3855. The examiner can normally be reached on Monday to Thursday, 7:30 a.m. to 5:00 p.m. ET.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richard Crispino, can be reached on (571) 272-1226. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Brian R. Slawski/
Examiner, Art Unit 1791

B.R.S.

/Richard Crispino/
Supervisory Patent Examiner, Art Unit 1791